

Title: Around and About Pattern Blocks

Brief Overview:

Students will apply their knowledge of area, perimeter, non-standard measurement, and pattern blocks to play and then design a fair game. After exploring area and perimeter, students will work cooperatively to write multi-step directions for a game they design.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

- **Number and Operations**

- *Understand numbers, ways of representing numbers, relationships among numbers, and number systems.*
 - *Understand meanings of operations and how they relate to one another.*
 - *Compute fluently and make reasonable estimate.*

- **Algebra**

- *Understand patterns, relations, and functions.*
 - *Represent and analyze mathematical situations and structures using algebraic symbols.*
 - *Use mathematical models to represent and understand quantitative relationships.*
 - *Analyze change in various contexts.*

- **Geometry**

- *Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.*
 - *Specify locations and describe spatial relationships using coordinate geometry and other representational systems.*
 - *Apply transformations and use symmetry to analyze mathematical situations.*
 - *Use visualization, spatial reasoning, and geometric modeling to solve problems.*

Measurement

- *Understand measurable attributes of objects and the units, systems, and processes of measurement.*
- *Apply appropriate techniques, tools, and formulas to determine measurements.*

Data Analysis and Probability

- *Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.*
- *Select and use appropriate statistical methods to analyze data.*
- *Develop and evaluate inferences and predictions that are based on data.*
- *Understand and apply basic concepts of probability.*

Process Standards

Problem Solving

- *Build new mathematical knowledge through problem solving.*
- *Solve problems that arise in mathematics and in other contexts.*
- *Apply and adapt a variety of appropriate strategies to solve problems.*
- *Monitor and reflect on the process of mathematical problem solving.*

Reasoning and Proof

- *Recognize reasoning and proof as fundamental aspects of mathematics.*
- *Make and investigate mathematical conjectures.*
- *Develop and evaluate mathematical arguments and proofs.*
- *Select and use various types of reasoning and methods of proof.*

Communication

- *Organize and consolidate their mathematical thinking through communication.*
- *Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*
- *Analyze and evaluate the mathematical thinking and strategies of others.*
- *Use the language of mathematics to express mathematical ideas precisely.*

Connections

- *Recognize and use connections among mathematical ideas.*
- *Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.*
- *Recognize and apply mathematics in contexts outside of mathematics.*

Representation

- *Create and use representations to organize, record, and communicate mathematical ideas.*
- *Select, apply, and translate among mathematical representations to solve problems.*
- *Use representations to model and interpret physical, social, and mathematical phenomena.*

Grade/Level:

Grades 3-5

Duration/Length:

Approximately three to four days

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Basic perimeter and area
- Geometric shapes
- Concept of fairness in games
- Measurement using non-standard units

Student Outcomes:

Students will:

- define perimeter and area.
- measure perimeter and area using non-standard units.
- apply knowledge of perimeter and area to design a fair game using pattern blocks.
- write to inform by creating multi-step directions for the game they develop.
- work cooperatively in groups.

Materials/Resources/Printed Materials:

- Pattern Blocks
- Unifix cubes
- White/drawing paper
- Crayons/Markers
- Overhead/transparency pens/transparencies
- Student Resource Sheets
- Teacher Resource Sheets

Development/Procedures:**Day 1**

- Review area and perimeter by completing warm-up task of finding the area and perimeter of students' pencil boxes using unifix cubes. Use **Student Resource Sheet 1**.
- Define area and perimeter while sharing answers for task one, **Student Resource Sheet 1**.
- Discuss real-life situations in which finding area and perimeter are necessary. Possible examples include: finding perimeter and area for a garden, perimeter/area of yard for a dog pen, and perimeter/area for a new house in a neighborhood.
- Explore patterns using pattern blocks. Allow time for the students to free-play before they begin the assignment. Using the overhead transparency, model how to use the green triangle as one unit of non-standard measurement, **Teacher Resource Sheet 1**.
- Complete **Student Resource Sheet 2** in groups. Teacher assesses students' group work for understanding of area and perimeter.

- Review **Student Resource Sheet 2** to check for understanding. See **Teacher Resource Sheet 2** for correct answers. (There is no area possible for the orange square or the tan rhombus. These shapes will not be used throughout the unit). Have students save their answer charts to review in Day 2.

Day 2

- Review measurement by completing **Student Resource Sheet 3**, warm-up task of creating a design using only the blue, green, yellow and red Pattern Blocks. Students will find the area and perimeter using the green triangle unit. Encourage students to use **Student Resource Sheet 2** to complete the activity.
- Using the overhead, review how to find the area and perimeter using the green triangle and share student samples of today's warm-up.
- Distribute **Student Resources Sheets 4-6**, and materials for playing the game.
- Review directions and model how to play the game. Demonstrate how to trace pattern blocks and record area/perimeter on tracing paper and on **Student Resource Sheet 6**.
- Allow enough time for the students to play **3** rounds. Help students switch roles and trace pattern. (For younger students, one player holds down pieces and another traces pieces.)
- Collect tracings of area and perimeter for assessment and for Day 3's warm-up.
- Write journals in class or at home about the game experience, **Student Resource Sheet 7**. Teacher may choose to include these questions in a class discussion: Which player won? What did they notice about the area and perimeter of their geometric design? Did it matter which color combination you were playing with in order to win? Is this a fair game? Why or why not?

Day 3

- Share models of student games from Day 2. Discuss differences of area and perimeter between yellow/red and blue/green geometric designs.
- Ask for volunteers to read and discuss journal entries about the game. Be sure to discuss the fairness of the red/yellow and blue/green geometric pieces.
- Distribute and read aloud the vignette found on **Student Resource Sheet 8** and read aloud rubric **Student Resource Sheet 9**. Students will demonstrate their knowledge of the concepts taught during the game.
- Score the game using the rubric provided on **Teacher Resource Sheet 3** and **Student Resource Sheet 9**.

Performance Assessment:

The students will be given a vignette on Day 3 to assess their knowledge of the unit (**Student Resource Sheet 8**). A rubric can be used to evaluate student performance (**Teacher Resource Sheet 3**).

Extension/Follow Up:

- Using the computer program **Math Keys**, have the students practice perimeter and area.
- Create new design using everyday objects looking for area and perimeter. Talk about other non-standard tools that can be used to measure area and perimeter.

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Can You Help Pocket Game, Inc.?

Task: A new game company, Pocket Game, Inc., wrote to several schools asking for some help with one of their projects. They have asked our class to help them by finding the area and perimeter of our school boxes. They want each student in our class to complete this task since so many students have different size school boxes. Once Pocket Game, Inc. finds the average size of most school boxes, they are going to design a game for students to keep in their boxes and play during their free time.

You will need to find the area and perimeter of your school box using unifix cubes. Record the area and perimeter below.

*Area of School Box = _____ unifix units

*Perimeter of School Box = _____ unifix units

Complete as a class:

*Define area-_____

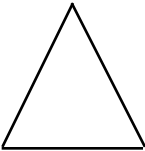
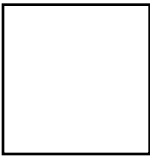
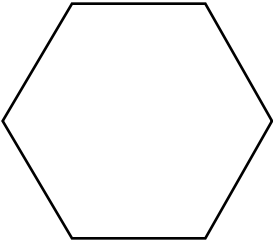
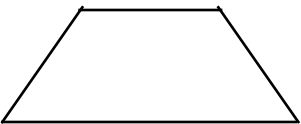
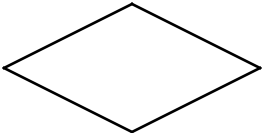
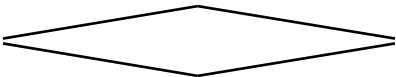
*Define perimeter- _____

*Discussion of how area and perimeter applies to real life.

Examples of real-life situations where area and perimeter would be measured:

Finding Area and Perimeter Using Pattern Blocks

Directions: Use the green triangle to measure the area and perimeter of each pattern block to complete the chart below. Measure the manipulatives provided by your teacher, not the shapes on this page.

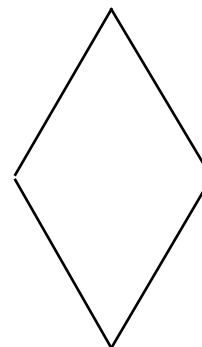
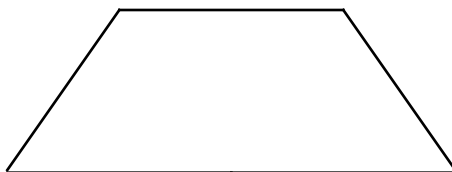
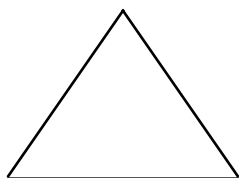
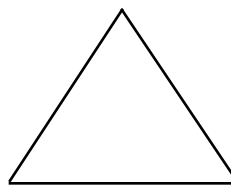
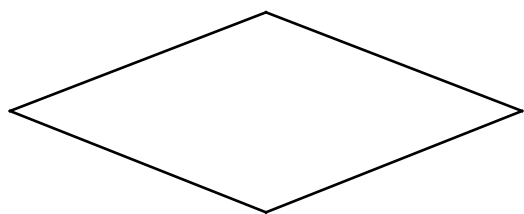
Shape	Area	Perimeter
	_____ green triangle units	_____ green triangle units
	_____ green triangle units	_____ green triangle units
	_____ green triangle units	_____ green triangle units
	_____ green triangle units	_____ green triangle units
	_____ green triangles units	_____ green triangle units
	_____ green triangle units	_____ green triangle units

A Handful of Designs

Directions: Create a fun design using a handful of pattern blocks. Keep in mind that the area of the orange and tan pattern blocks can not be measured with the green triangle. Therefore, do not use the orange and tan pattern blocks in your design. Once you finished your creative design, find and record the area and perimeter using the green triangle unit.

*Area of Design = _____ green triangle units

*Perimeter of Design = _____ green triangle units



Playing with Patterns

Materials Needed:

pattern blocks
drawing paper
crayons/markers
recording sheet

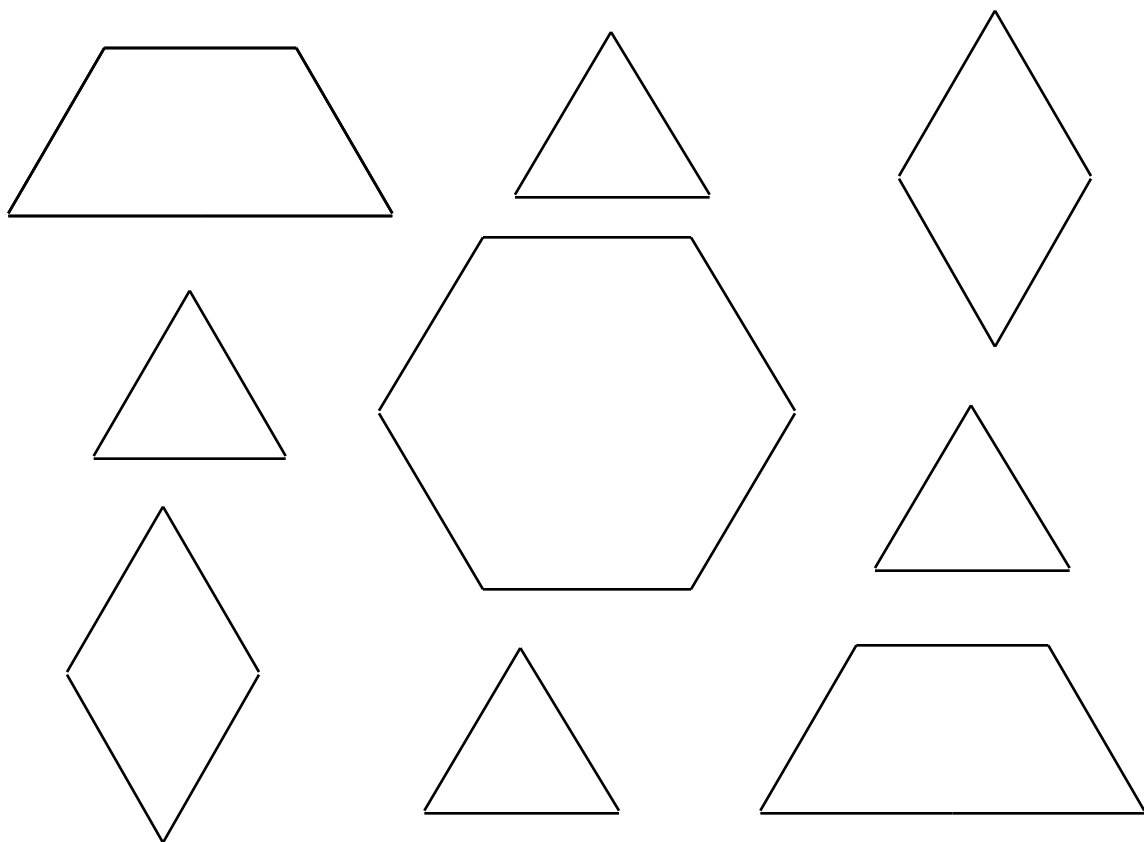
Number of Players: 2

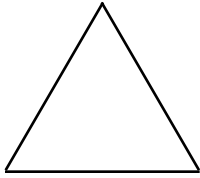
Object of the Game: The winner is the person who has the largest sum of perimeter and area after each round.

Follow these directions:

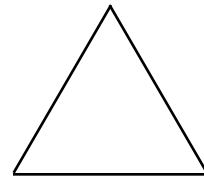
1. Decide who will be Player A and who will be Player B.
2. For the first round, Player A will use 2 yellow hexagons and 4 red trapezoids and Player B will use 2 blue rhombi and 4 green triangles.
3. Both players will use their designated pattern blocks from step #2 to create a geometric design that has the largest perimeter each player can find.
4. On the drawing paper, each player must trace the geometric design they created in step #3.
5. After tracing the design, each player should use the green triangle to measure and record the perimeter and area on the drawing paper. Then, each player should record the perimeter and area on the Recording Sheet underneath Round #1. Record the winner of Round #1.
6. For the second round, switch pattern blocks so that Player A will use 2 blue rhombi and 4 green triangles and Player B will use 2 yellow hexagons and 4 red trapezoids.

7. Follow steps 3, 4, and 5 above to complete Round #2. Then, record the winner of Round #2 on the Recording Sheet.
8. For the last round, Player A will use 3 yellow hexagons and 5 red trapezoids and Player B will use 3 blue rhombi and 5 green triangles.
9. Follow steps 3, 4, and 5 above to complete Round #3. Then, record the winner of Round #3 on the Recording Sheet.
10. Make sure your recording sheet is complete.





Playing with Patterns Recording Sheet



Record the results of the game Playing with Patterns on the chart below. You and your partner will play three rounds.

Round One

	Area	Perimeter	Sum of Area & Perimeter
Player A			
Player B			

Round Two

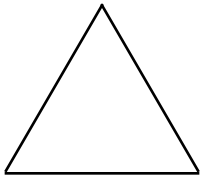
	Area	Perimeter	Sum of Area & Perimeter
Player A			
Player B			

Round Three

	Area	Perimeter	Sum of Area & Perimeter
Player A			
Player B			

* Which player won the most rounds of play?

* Why do you think this player won more rounds?



Playing with Patterns Journal Response



You have just played the game Playing with Patterns. In your opinion, do you think this game was fair for all players? Justify your response with at least two reasons.

Vignette for Designing Games

Writing to Inform

The principal heard about our success in learning about area and perimeter by playing the game, Playing with Patterns. Our principal wants us to design games that other classes can use to learn about area and perimeter. She believes that students develop a better understanding of mathematical concepts by learning through hands-on experiences. Your task is to create a game for other students that will help reinforce area and perimeter.

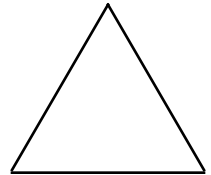
Your game should include the following:

- *Area and Perimeter
- *Pattern Blocks
- *Written directions, including materials needed, number of players, object of the game, and multi-step directions
- *Must be fair for all players
- *CUPS (correct use of capitalization, grammar usage, punctuation, and spelling)

Notes for Teachers

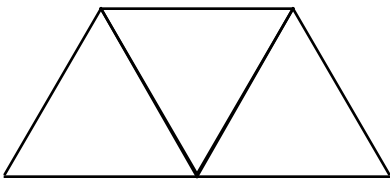
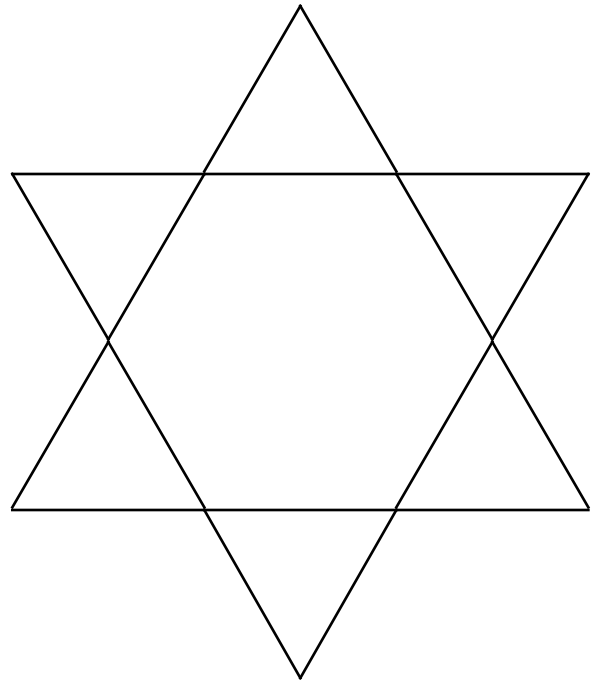
Finding Area and Perimeter Using Pattern Blocks

1. The activities in this unit require students to use non-standard units of measurement to find the area and perimeter of pattern blocks. The unit of measurement used for the activities is the green triangle.



2. Students will use one side of the green triangle to measure the perimeters of the other pattern block figures. It is important that students remember where they begin counting to avoid mistakes.

The perimeter of the yellow hexagon equals 6 green triangle units.

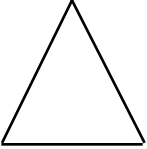
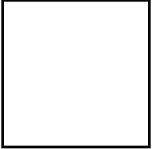
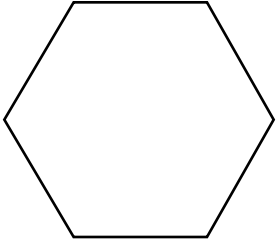

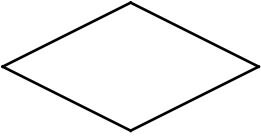
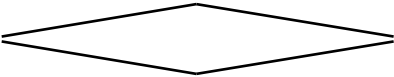


The area of the red trapezoid equals 3 green triangle units.

3. Students will use the green triangles to measure the areas of the other pattern block figures. Students will arrange the triangles to cover the shapes. It will not be possible to find the area of the orange square or the tan rhombus because of their shapes. The orange square and tan rhombus will not be used throughout the unit.

Finding Area and Perimeter Using Pattern Blocks

Directions: Use the green triangle to measure the area and perimeter of each pattern block to complete the chart below. Measure the manipulatives provided by your teacher, not the shapes on this page.

Shape	Area	Perimeter
	<u>1</u> green triangle units	<u>3</u> green triangle units
	not <u>possible</u> green triangle units	<u>4</u> green triangle units
	<u>6</u> green triangle units	<u>6</u> green triangle units
	<u>3</u> green triangle units	<u>5</u> green triangle units
	<u>2</u> green triangle units	<u>4</u> green triangle units
	not <u>possible</u> green triangle units	<u>4</u> green triangle units

Designing Games Rubric

- 3 Points = Game requires players to find area and perimeter.
Game uses pattern blocks.
Complete multi-step directions which include materials needed for play, number of players required, and object of the game.
Game should be fair for all players.
Correct capitalization, grammar usage, punctuation, and spelling used most of the time.
- 2 Points = Game requires players to find area and perimeter.
Game uses pattern blocks.
Some multi-step directions which include materials needed for play, number of players required, and object of the game.
Game should be fair for all players.
Correct capitalization, grammar usage, punctuation, and spelling used most of the time.
- 1 Point = Game requires players to find area and perimeter.
Game uses pattern blocks.
Incomplete multi-step directions which aren't very clear for players.
Directions include some materials needed for play.
Directions include number of players required and object of the game.
Game is somewhat fair for all players.
Correct capitalization, grammar usage, punctuation, and spelling used some of the time.
- 0 Points = Game does not require players to find area and perimeter.
Does not include multi-step directions.